Securing participation: Experiments in a one-day introduction to economics

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Classroom experiments and exercises served as a one-day introduction to economics for students who felt insecure about taking first-year business classes. The first experiment addresses demand in isolation, while the second addresses supply. Supply, demand and equilibrium are integrated in a pit market in which all students have equal expected profits. A monopoly pricing exercise addresses market failure. Exercises use many incremental questions to reveal principles of microeconomics. Evaluations show that at the end of the program, students were familiar with economic results and concepts, and were more comfortable with taking economics.

INTRODUCTION

Experiments and exercises introduced 128 incoming first-year university students to microeconomics. These students were participating in a five-day introductory school in accounting, finance, and economics marketed to students transitioning from high school, who felt unprepared for university level units in those subjects. Evaluations showed basic proficiency with economics concepts, and an increase in comfort with economics. (The experiments and exercises are available electronically in Geller 2005, at http://www.deakin.edu.au/buslaw/aef/publications/workingpapers/2005-12.pdf, and may be used with copyright acknowledgement and citation.)

This section of the paper continues with a brief introduction to the program, experiments, and evaluation. The following sections will detail the teaching and learning activities of the economics program, with the various experiments and exercises. The next section presents an evaluation of the program. The final section concludes.

As a one-day introduction, our program had the objective of increasing student comfort with taking first-year economics, and providing students without previous economics experience with a foundation of economic knowledge. Forty-nine students attended the introductory school on a regional campus, and another 79 students attended the following day on an urban campus. None of the students attended both sessions, as each cohort was participating in a week-long program on their respective campuses. Both cohorts had received two days of accounting lectures, and the second had also received one day of finance lectures. Our one-day introduction to economics program had four class-room sessions separated by breaks, with each session dominated by active learning with experiments and exercises, but containing some lecture type presentation.

Students paid $231 for the five days of the introductory school. One could reasonably consider $42 of that to be payment for the economics component, net of GST. We used 22 sheets of photocopied material per participant, since much of the material was copied, with two pages per photocopied sheet. Our faculty cost-accounts photocopies at two cents per sheet. Preparation for the exercises took most of a work day: updating a
bond, photocopying, printing and reviewing instructions, and preparing overhead slides. As a currently employed lecturer, one could reasonably cost my time at $50 per hour over three days. Thus, we could approximate the cost versus return for the school of this introduction to economics program to be that a cost of about $1,256 returned about $5,376. Reality differed widely from this model as to who actually paid the costs, and who received the revenues.

These experiments and exercises have several objectives more specific than the program objectives:

- Introducing students incrementally to the elementary principles of supply and demand including equilibrium, changes of curves, market outcomes, and market failures.
- Providing the students personal experience of supply, demand, and related processes.
- Creating interaction between students, and giving students a common experience of economic phenomena.
- Building student ability to perform basic economic skills such as drawing diagrams.

These experiments and exercises grew over several years of teaching, without direct reference to published materials on classroom experiments. However, they show indirect influence through seminars, classes on research experiments, and experiences with the experimental economics laboratory at Georgia State University in the 1990s. There is a large literature on classroom economics experiments. Charles Holt’s website at the University of Virginia, http://www.people.virginia.edu/~cah2k/teaching.html, has many experiments and descriptions of much of the literature on economic experiments, including instructional ones for classroom use. Holt (1999) provides an excellent overview of the broad range of classroom experiments.

The experiments presented here contribute to the body of experiments in three ways. First, they isolate demand and supply individually in two separate experiments. Second, the unusually detailed exercises ‘baby-step’ students through discovery of economic principles, and provide correct responses several lines after students address key issues. This level of detail and prompt checks make these exercises suitable for students who were absent from the experiment, or who study economics through distance learning. Third, these experiments are equitable in the sense that all students have the same potential to earn points or money, and that none are excluded from participation through limited numbers of roles in games, or through the need for non-participating assistants.

The evaluation instrument for the economics program in our introductory school was intended to provide feedback on teaching, and was not designed as a scientific instrument. For example, it lacks demographic controls, any use of a control group, and does not test for prior knowledge. The accounting and finance programs had no separate evaluations. Our interpretation of results is constrained but offer interesting suggestions.

The program was apparently successful. Eighty-eight percent of students who responded to an end-of-day evaluation expressed greater comfort about taking economics units. Further, three of the five participants who expressed no increase in comfort drew supply and demand diagrams properly, read equilibrium price and quantity from their diagrams, and correctly answered at least half of the multiple choice questions applying supply and demand.
BEGINNING THE PROGRAM

The program consisted of four sessions. The first session included a thirty-minute introduction and overview of economics, an auction of a bond, and completion of an exercise using auction results to illustrate demand. The second session had a ten-minute question and answer session on the bond auction exercise, a nightmare auction (detailed below) illustrating supply, and the beginning of a pit market experiment illustrating the interaction of supply and demand. The third session completed the market experiment, and began an exercise investigating the market experiment. The final session completed the market exercise, and an exercise on monopoly power.

I started the program by introducing myself, including my qualifications and experience. Then I explained economics as the science, art, and mathematics of doing the best we can with what we have. ‘We’ can vary between individual, family and societal scales; ‘best’ can take a variety of meanings. Our one-day program in economics served as an illustration of constrained maximisation in which I had to make choices about what material to address, as well as how to address it in the limited time available. My approach was to be unconventional, active, participatory, and used experiments. Students need not understand the lessons and objectives of the experiments while we did them, rather the meanings would become clear during the written exercises or even later. I finished by requesting their tolerance of the unusual approach, and asked for their participation.

BOND AUCTION

The first exercise of the day was a sealed-bid, second-price auction of a bond. The bond auction illustrated demand, but also introduced the idea of bonds as well as providing an opportunity to explain interest rates. A sample bond, instructions, and the bond exercise are available in Geller (2005).

While projecting a transparency of the bond, and showing a twenty-dollar bill to the students, I explained that a bond is merely a document of debt with a specific date for payment. I would pay someone – whoever brought the bond to me – twenty dollars at the end of the semester. I would also take money from someone – the winner of the auction – that day. This auction provided an opportunity to explain interest as the reward for delaying use of money for consumption, as well as interest as the difference between the price of a bond and the redemption value. I noted my name, position, and university on the bond, illustrating the role of accountability and credibility in bond value. I also noted that I could die before the maturation date, introducing the concept of risk and why the bond cannot be worth more than twenty dollars. The latter point, while not strictly true, is important: if I were to make a ‘profit’ by receiving more than twenty dollars, someone may complain that I had abused my position, thereby causing me inconvenience.

The auction for the bond is a second-price auction. Winners did not pay the amount they bid, but rather they paid the second-highest bid amount. This invited an explanation of incentive compatibility, the reason for the use of the second price, so I gave a brief description of the role of incentives in economics. If winners paid their bid, they would have an incentive to report a bid lower than the highest amount they were actually willing to pay. By making the payment the second-highest bid, the planner of the experiment has removed the incentive to report falsely. The incentives of the procedure
are compatible with the teaching objective of revealing demand. Notice that this approach introduces the concept of demand as willingness to pay.

The students wrote their names on slips of paper with the most they would be willing to pay in order to get twenty dollars at the end of the semester. The students passed the pages to the end of the row, and the student on the end sorted them from high on the bottom to low on the top. I restacked them into one pile with low on the bottom and high on the top, and wrote the bid prices quickly on a projected transparency. The students copied the bids to use in their exercises. Figure 1 gives the results of the bond auction as a diagram.

While students copied the bids, I distributed the bond exercise that guides the students through organizing the bid data into a diagram. Groups of two to four students completed this exercise in about 35 minutes. Each student received an individual write-up, as it provided notes on demand. I told the students that the exercise was written for diverse students. Most of the questions were very elementary (see Appendix 1 for examples), and should be answered on face value.

![Figure 1: Bond auction bids](image)

I walked around the room giving help. After five minutes I spent two minutes addressing the group as a whole, to guide the students through the first seventeen questions. These questions merely orient the students to the bids and label the diagram. After fifteen minutes, I briefly extended the students through the next seven questions that plot demand prices. Most students had progressed further, but a brief summary advanced those who lagged. After 25 minutes I reviewed fourteen more questions, taking the students through quantities demanded and demand prices. This left seven minutes, and most students completed the exercise.

The final dozen questions addressed shifts of demand curves. First, we addressed the probable effects of decreasing the class size by one-half. Then we considered the possible income effect if all the students were to have received $100 before class.
The objectives of the bond experiment focused on a simple introduction to demand. Students thought explicitly about a dollar value of the benefit of a purchase. In the written exercise, students plotted points and drew curves, found demand prices and quantities demanded, shifted demand curves, and listed factors that shift demand. The objectives go beyond demand, in that students are exposed to vocabulary relating to finance and macroeconomics.

**SUPPLY AUCTION**

In the nightmare auction, students submit the lowest payment they would accept to live through the anxiety nightmare of being the only person naked in class. The objectives of this exercise are to:

- Introduce supply, highlighting the role of costs.
- Introduce and illustrate implicit and explicit costs.
- Show upward-sloping supply as an increase in marginal cost.
- Introduce shifts of supply.
- Show an increase in the marginal cost schedule as a decrease in supply.
- Introduce the idea of simplified models, and the conditions of perfect competition.

The procedures in this experiment are emotionally sensitive; gradual introduction helps. I made sure that several points were clear to the students, and explained some issues before revealing the nature of the auction. I advised the students to select someone they knew well, whom they could ‘speak for’ on privacy issues, and that the easiest person would be themselves – but they could select someone else if they wished. They need never reveal who they chose. This technique of second-person response, adapted from anthropology, allows participants to reply with limited intrusion on their privacy. I told the students that, unlike the bond experiment, they would not reveal their names, no money would change hands, and the winner would not do what was auctioned. Given the sensitive nature of the topic, I did not aggressively encourage participation.

I gently introduced the topic: ‘When I was young, we had this anxiety nightmare. We’d look up and realise that we were the only person in class with no clothes on.’ Using the instructions in Geller (2005), I invited the students to consider the lowest amount of money they would accept to live through that nightmare. Each then wrote that amount on a slip of paper.

I then collected the papers as with the bond, but stacked with high on the bottom and low on the top. I kept an eye out for interesting cases. Is one billion dollars a thousand-million (US) or a million-million (UK)? What is the daily interest on a billion dollars anyway? Such patter gave them something to do during the stacking. In each session, someone computed the interest. Some students actually specified goods – unambiguous real prices. Others were specific unrounded dollar amounts, which were likely to be for a specific purchase – again a real price. Such real prices provided an opportunity to discuss nominal and real. Some participants expressed surprise to find out that money is not real, and that economics is not about money.

With the stack finished, I plotted the prices on a diagram. Our results are in Figure 2. There is no written exercise for the nightmare auction, as the specific skills and lessons would largely repeat the bond auction. Instead, I demonstrated the work.
In my experience at several Australian and US universities, many beginning students do not know how to draw diagrams. So I showed them how to establish the length of the quantity axis, and the height of the vertical axis. As Figure 2 shows, I had to use a logarithmic scale on the price axis. Base ten provided a comfortable high-school reminder for students: 1, 10, 100 … Mention of logarithms brought sounds of distress, but presentation of the numbers on the axis triggered visible relief. Thus this introduction of ‘scary’ material, and taming it, was reassuring to the students – a primary objective of the introductory school.

I explained that one begins plotting supply schedules with the lowest numbers first, because buyers sort them that way. They buy from the cheapest sources first before more expensive ones. Students were sceptical. I explained that economists assume that all the goods are exactly interchangeable – equally useful naked bodies – and allowed further scepticism to remain for the final punch line. In general, buyers select the lowest cost unit, and then select progressively more costly units. This is an example of increasing marginal cost, and supply is marginal cost.

I challenged the students: ‘I said supply was marginal cost. What costs are there in being the only person naked in class?’ The students offered a series of implicit costs, including loss of social standing, embarrassment, loss of friends, et cetera. One person mentioned the possibility of legal costs. I asked the students if loss of social standing and embarrassment were ‘real’. They agreed both were. At this point we can see supply on a diagram illustrating increasing marginal (mostly implicit) costs.

The final stage of the nightmare auction introduced shifts of supply, increase of the marginal cost schedule as a supply decrease, and the concept of ceteris paribus. I
repeated the nightmare auction, saying that everything would be exactly the same as before, except for one condition. I explained that the practice of making one change at a time is important in economics, as it allows for interpreting the effects of specific causes. The one change in the nightmare auction was that ‘this time, pretend that your oldest living relative who can see is in the room with the class and you’. I asked people to raise their hands if they (or their alter-ego) would be willing to be naked for a lower payment than before, and got no volunteers. When I asked who would require higher payment, about half the students raised their hands.

Returning to the supply diagram, some of the points moved higher with ‘grandma’ present, some stayed at the same height (showing no change in cost of producing the product), and none moved downward. So the curve in aggregate moved upwards. I reminded them that when asked for a show of hands, the participants indicated that they were less willing to provide the product, not more willing. Therefore an increase in marginal costs (pointing upward on the diagram) is a decrease in supply (pointing leftward on the diagram).

The final aspect of the nightmare auction was to ask the students if the example was realistic. They said no. Then I told them that in the upcoming semester, there would be classes with one naked person, and any naked person was as good as any other – figure drawing in arts.

The nightmare auction introduced costs: implicit and explicit costs, increasing marginal costs and upward-sloping supply, shift of supply, and an increase in marginal cost as a decrease in supply. It illustrates vividly that implicit costs are real. It foreshadows perfect competition and the use of assumptions, while challenging participants’ ideas about what is realistic.

**PIT MARKET EXPERIMENT**

The third event of the introduction to economics program was a market simulation ‘pit’ experiment that integrated supply and demand. It introduced equilibrium, demonstrated demand and supply along with shifts of both, illustrated the level of precision in an equilibrium, showed supply and demand as a predictive model, and further introduced the concept of perfect competition.

This pit experiment shares features, good and bad, with Chamberlin (1948). Chamberlin found that the quantity traded in his experiments often exceeded the equilibrium quantity, due to his market breaking into smaller markets around the classroom and resulting in inefficient trades. Holt (1996) addressed this phenomenon in detail. Smith (1962) resolved the problem by having buyers separated from sellers, with each group calling successively more favourable bids to the other until a trade price is agreed upon – a double auction. I found Chamberlin’s method of having all buyers and sellers circulate in the room to be effective in large classes. Holt noted that pit auctions could be difficult and slow in large classes: ‘With large classes it is better to use the students near the aisles and let the others watch’ (Holt 1996, p. 196); ‘Classroom experiments are more difficult to use effectively in large classes, since it is the personal involvement that stimulates student interest’ (Holt 1999, p. 607). I have not experienced severe problems using pit auctions. Even in large classes of up to 150 students, rounds usually finish in five or six
minutes. Also, when one is trying to encourage students, participation by all students can be worth the cost of potentially weaker results. Of course, the double-oral auction format provides much more public information and faster convergence to equilibrium.

The market simulation experiment divided the participants as evenly as possible into buyers and sellers. Each participant received a sheet (see Appendix 2, also available with all other supporting material in Geller 2005) divided into seven playing rounds, and documenting two units of an abstract commodity ‘stuff’ for each round. Sellers have the costs for each unit of stuff, and buyers have a ‘resale value’ for each of two units. Sellers make profits by selling units for more than their cost, and buyers make profits by buying units for less than their resale value. The values and costs are set so that each participant has an equal expected profit. That is, if each unit were to trade at the equilibrium price, each participant would earn equal profit. As an incentive to participate industriously, I treated each point of profit as a ‘lottery ticket’ to win twenty dollars. Students did participate enthusiastically, and I conclude that twenty dollars was sufficient motivation. If one were to use this experiment in a regular class, one might be tempted to use profit as class marks as an incentive, since all students have equal chances to earn profits. However, be aware of strong arguments against this practice (Stodder 1998; Cheung 2003).

The market experiment was designed for classes in multiples of twenty. However, buyer and seller sheets were arranged so that other numbers can participate with only minor distortion of results. On the first day of our introductory program there were 49 participants, and on the second day there were 79. I did not retain records on the first day, as I had not thought of writing this piece. On the second day there were 39 sellers and 40 buyers.

I read the instructions of the game to the participants, showing them example buyer and seller sheets as well as demonstrating how to record trade prices and other information, and how to compute profit.

The market experiment began with a practice round in which the profit did not count as a chance to win money. The directions for the experiment state that rounds last five minutes, however I allowed the practice round to run for seven minutes, allowing the participants to practice. Participants were clearly hesitant, with many playing from their seats. I walked through the classroom checking sheets, reminding people to only play the practice round, to buy low and sell dear, and other aspects of the instructions.

The demand and supply curves for the practice round were \( P_D = 50 - 0.2Q_D \) and \( P_S = 20 + 0.2Q_S \), with \( Q \) expressed as a percentage of the participants. Equilibrium price and quantity were 35 points/unit and 75 percent of the class size of units. The class reported 48 trades. Specifically, I asked all buyers who had traded no units to raise their hands, and none did – establishing at least 40 sales. Then I asked all buyers who had bought two units to raise their hands; eight did – establishing 48 sales or 61 percent. Of course, many or most participants had no idea at that time of the specifics of supply and demand, or even that the concept of equilibrium existed, much less what the equilibrium was in this case. I asked buyers who traded in the last two minutes of the game to raise their hands, and then asked them to tell me the trading price. They reported prices of 26.5, 35, 39, and 32.
The buyer and seller sheets provide another source of information on the trade prices and quantities. Participants provided their buyer and seller sheets to me in order to have a chance of winning the twenty-dollar reward. Most but not all participants provided a sheet. I was able to use these sheets as a measure of trades and prices. Having both buyer and seller sheets allowed me to confirm most trades, exclude several errors, and find one participant’s version of trades involving those participants who did not provide their sheets. I do not consider either the verbal classroom reports or the sheets to be a
precise measure of the experimental results, but they agree in substance if not detail. During the experiments, students recorded time in discrete minutes. In Figure 3, these times have been altered by a delta variation to permit clearer diagrams.

The supply and demand curves remained the same for the first and second round as in the practice round. Now that the participants were familiar with the game, and playing with a chance to win money, they played more enthusiastically than in the practice round. Buyers reported 53 trades, or 67 percent. They reported prices of 38, 33, 33, 35, 36, 34.5, 36, 31 and 34, averaging 34.5. Figure 3 reports a similar but not identical story. Apparently, a last minute buyer declined to report a zero profit trade at 42.5. Although the reported figures are imperfect, prices converged near equilibrium, and the quantity approached equilibrium quantity. Buyers in round two reported 54 trades, or 68 percent, with final prices of 34.5, 33, 36, 36 and 38.5, averaging 35.5.

In round three, I bought the trading rights from ten buyers through tâtonnement auction in order to demonstrate a decrease in demand. I asked for a show of hands for buyers who would be willing to ‘sit out’ of round three and not trade any units. They would receive ten points in compensation. Few raised their hands. Since the experiment calls for one-quarter of the buyers to sit out, I then suggested twenty points and around twenty hands went up. I suggested lower prices when too many raised their hands and higher prices when too few did. We settled on a compensation of sixteen points for ten buyers to sit out of round three. The result was 40 reported trades (50%) with an average of final prices being 31.5.

It is impossible, a priori, to give the equilibrium prices for rounds three and four, since we cannot know which buyers will accept the buy-out. However a 25 percent reduction in demand, drawn shifted or rotated from the price axis, yields a predicted equilibrium of about 63 or 64 percent, and a price of about 32 or 32.5. The buyer and seller sheets tell substantially the same story (Figure 3), with 38 trades and the final prices averaging 32. In round four, ten buyers sat out for fifteen points. Buyers reported 43 trades, with the prices in the last minute between 30 and 35, yielding an average of 32.5. Figure 3 shows two fewer trades but is close to the reported results.

Note that I asked buyers to report trade prices in rounds three and four, when the equilibrium price had fallen. In the past I have noticed a small bias in participant reporting of results. Buyers occasionally decline to report high prices, and sellers occasionally exclude low prices. Apparently, students hear other prices being reported and adjust their numbers or lower their hands before I can call on them. This bias can help in the classroom, although the distortion would be problematic in research. Comparison between reports and participants’ sheets reveals that in round three, reported final prices were slightly lower than those on the sheets. In rounds three and four, two more trades were reported than were supported by the sheets. Also in round four, a last-minute trade was reported at 33.5 points that was not supported by the sheets, whereas a 30 point trade went unreported. Of course, I may have miscounted the raised hands or misheard called prices.

Quantities traded were consistently lower than the predicted equilibrium quantity. This suggests that there were some costs that affected both buyers and sellers. Such undocumented costs would shift both supply and demand inward. It is easy to propose possible costs, such as the inconvenience of moving around the room and seeking trades.
In rounds five and six all buyers participated, and ten sellers sat out for payments of eight and eleven points respectively. The equilibrium price rose to 37.5, while the quantity fell to 64 percent of the class or 51 trades. Consistent with the day’s experience, a lower than expected number of trades occurred, with final prices close to the expected equilibrium. Sellers reported 45 trades in each of rounds five and six, with the average of the final prices being 36 and 37.5 respectively. Buyer and seller sheets record comparable results of 46 trades each round, and prices in the final two minutes averaging 37 and 38.5 (see Figure 3).

Participants learn from the market experiment through completing a 53-question exercise (available in Geller 2005). This exercise was developed so that students can complete it independently or in small groups. Important or informative answers are often presented in descriptions shortly after relevant questions, providing students with prompt feedback and preventing them from going too far astray. The exercise relies upon the students having access to the instructions introducing the market experiment, the number of participants in the exercise (class size) as well as the number of trades and final prices for each of the trading periods. With that information, students who did not participate in the experiment including off-campus students may complete the exercise. I explained that some questions may be aimed at particularly interested students, and are identified by statements such as ‘interested students may want to’. Most students should ignore such questions.

Since I seldom know the number of participants before running this experiment, the exercise allows for any number of participants. Unfortunately, this requires an awkward rescaling of the quantity axis of the diagrams in the exercise, which must be completed at the beginning of the exercise. Students who missed class and off-campus students must use the directions at the beginning of the exercise. In classroom practice and in the one-day program, I tell the students what numbers to put on the quantity axis.

The market simulation exercise consists of three sections, reflecting the initial equilibrium, the decrease in demand, and the decrease in supply. In the remainder of the first section, after labelling the horizontal axis, participants identify equilibrium through comparing marginal costs with marginal benefits, and then compare the theoretical equilibrium with empirical results from the experiment. Unlike most introductions to economics, this exercise presents participants with an example of the dispersion of results around equilibrium. The second section relates buyers to demand, and shows a change in demand with its effects upon the equilibrium. The final section presents the same lessons for supply.

MONOPOLY EXERCISE

The last exercise of the day presented students with monopoly price-setting, and foreshadowed market failure (Appendix 3). Although it is simple and straightforward, requiring little explanation, this exercise contains valuable lessons and provided a comfortable end to a long day of learning. As well as introducing monopolies and the concept of a price maker, the exercise introduces profit maximisation; total, fixed and, variable costs; total revenue; as well as supply and demand as a system of equations.

This exercise presents students with a downward-sloping demand curve and a horizontal marginal cost curve. It then guides them through calculations of revenue, cost, and profit.
It provides details of a zero profit example, and invites the students through a profitable – but not profit maximising – example. The students then try to find the maximum profit through trial and error, in effect performing a drill on relating profit to total revenue and total cost, and relating price to demand. In the one-day introduction program, participants completed this exercise in small groups or individually as they chose and nearly all completed it in about twenty minutes. During that time, I moved through the class answering questions. Students asked for clarifications of instructions, for checks on their work, and how to relate prices and quantities. For the latter point, I referred them to their bond exercise.

I debriefed the students afterwards, asking them to tell me the highest profit. Most found $400, the correct answer. I then showed a projection of a diagram with the demand and marginal cost curves, and showed how to find the profit-maximising price and quantity using the marginal revenue curve. I did not explain how to derive marginal revenue, but rather how to draw it from a linear demand curve. Participants appreciated the speed of the technique. My intent was to whet their appetites for more potentially useful techniques and insights in the semester to come.

**CLOSING THE PROGRAM**

I finished the introductory program with a five-minute summary of what we learned. First, I told them that I would like them to complete an evaluation of my program before they left. I forewarned them that the evaluation would quiz them on the material, so that I could find out what they had learned. It would not evaluate them, because their names would not be on the forms. I requested that they do their own work so that I may get good information, and be able to improve the program. Then I summarised what we had done, reviewing demand and benefits from the bond exercise, supply as costs from the nightmare auction, demand and supply interacting in the market experiment, equilibrium, shifts of supply and demand, market results, and monopoly pricing. While distributing the evaluation I thanked them for participating, requested that students who had taken economics previously place their evaluations in one box on my podium, and asked the rest of the students to place their evaluations in a box by the exit.

**EVALUATION**

The evaluation of the economics program of the introductory school (Appendix 4) was an instrument to improve my teaching, not a research instrument. Summarising economic principles immediately before distributing the evaluation served the purposes of our program, not scientific objectivity. Therefore, conclusions using the instrument are broad and imprecise. However, the evaluation was sufficient to suggest some interesting conclusions.

<table>
<thead>
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<th>Table 1: Evaluation results – Students with no previous economics</th>
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<td>More comfortable about taking economics?</td>
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<tr>
<td>Marginally yes</td>
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</tr>
<tr>
<td>Total</td>
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46
Sixty-seven students who had not previously taken economics returned the evaluation. Of these, 59 said that they were more comfortable about taking economics (question 1) including thirteen who volunteered that the increase was limited. Five reported no increase in comfort, and three did not respond (Table 1). Six students who had previously taken economics also returned evaluations, for an overall response of 73 out of 128 participants.

The evaluation had eight questions, but evaluated ten aspects of economic performance. Question two revealed two criteria: 2a) did the student label price and quantity on the diagram, and 2b) were supply and demand drawn properly, sloping upward and downward respectively, and labelled? Question three required that the student find both equilibrium price and quantity (rounding permitted). Questions four to seven were interpreted as stated on the evaluation instrument. Question eight served as two questions, with price and quantity treated distinctly. The tenth point was: ‘did the student draw a changed supply or demand curve in order to answer questions four to eight on the evaluation?’

The students performed at a passing level (50%) except on the tenth point. Few students drew a curve as a tool in finding the effects of a change. I did not tell them to draw curves generally to find the effects of changes, nor did I direct them to do so in the evaluation. I ‘role-modelled’ drawing curves, and had them draw changes in curves in the market experiment exercise; however I did not present the technique as a general practice. Clearly, I should have explained the usefulness of drawing curves more explicitly, as only three participants used the technique. The other major problem area was with relating marginal cost to economic results. Half of the students gave incorrect answers for each of questions six and seven on marginal cost.

Overall, students received passing marks for the material we addressed. Those who replied that they were more comfortable about taking economics answered two-thirds of the evaluation questions correctly. Those reporting little or no increase in comfort responded correctly on 59 and 56 percent of the items respectively (Table 2).

<table>
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<tr>
<th>Comfort</th>
<th>Percent of test questions correct</th>
<th>Drew supply and demand correctly</th>
<th>Found equilibrium price and quantity</th>
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**SUMMARY AND CONCLUSION**

Experiments and exercises provided an effective base for a one-day introduction to economics program. The program increased participants’ comfort about taking economics, and provided them with a foundation of knowledge of economics. Specifically, students built from a foundation of direct decisions and personal experience the central concepts of demand as willing to pay, and supply as marginal cost. They participated in markets through the process of finding equilibrium, and adjusting to supply and demand shocks. Further, they began to develop skills in diagramming supply, demand, and equilibrium. In the process, they encountered many economic concepts including: monopoly, ceteris paribus, perfect competition, simplifying assumptions, et cetera.
An end-of-program evaluation showed that a large majority of participants were more comfortable about taking economics, and that half to two-thirds of them could already demonstrate use of basic economic concepts. However, the program was apparently weak in getting students to use economic tools of analysis, specifically supply and demand diagrams and drawing changes in the curves. I hope other instructors find these experiments useful, and would appreciate any comments on their application and effectiveness.

REFERENCES


APPENDIX 1

*Bond auction exercise example questions*

1) Look at the amounts of money that people said they would be willing to pay for the $20 class bond.

2) If you had to sell one bond to the class, which price would you sell it for?

3) In 2), did you pick the highest price?

3’) If you picked a lower number on purpose, answer the following three questions:

   a) Why did you not pick the highest price?

   b) Do you prefer to have less money when you could have more?

   c) Do you think most people who sell stuff would prefer to get more money rather than less for the stuff?

We will assume in this class that sellers try to sell for high prices. This assumption is useful. For the rest of this exercise, please assume that you, and any other seller of bonds, would prefer to get more money rather than less.

4) How much could you sell a second bond for?
### Experiment decision sheet for buyer 41

<table>
<thead>
<tr>
<th>ROUNDS</th>
<th>Practice</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
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<td>Value</td>
<td>310</td>
<td>210</td>
<td>320</td>
<td>1.15</td>
<td>12.20</td>
<td>720</td>
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<td>– 273</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Profit</td>
<td>= 37</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Time</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seller</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2nd UNIT</strong></td>
<td>Value</td>
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<td>155</td>
<td>180</td>
<td>.95</td>
<td>4.60</td>
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<tr>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Profit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Seller</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Profit for round (Sum of two units)</td>
<td>37</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative profit (Sum for all rounds)</td>
<td>37 (Equals above)</td>
<td>(Equals above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
</tr>
<tr>
<td>Profit for round (Sum of two units)</td>
<td>37</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative profit (Sum for all rounds)</td>
<td>37 (Equals above)</td>
<td>(Equals above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
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</table>

### Experiment decision sheet for seller 18

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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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</thead>
<tbody>
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</tr>
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<td>Time</td>
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</tr>
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<td></td>
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</tr>
<tr>
<td></td>
<td>Cost</td>
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<td>270</td>
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<td>1.40</td>
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<td></td>
<td>Time</td>
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<tr>
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<td>Buyer</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Profit for round (Sum of two units)</td>
<td>58</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative profit (Sum for all rounds)</td>
<td>58 (Equals above)</td>
<td>(Equals above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
</tr>
</tbody>
</table>
APPENDIX 3

*Monopoly written exercise*

What happens when there is only one seller, and no others to force the seller to charge a competitive price? That is, what happens when there is a monopoly seller who gets to set the price of a good? Use the graph below to do this exercise and find out.

As we saw in the supply and demand experiment, competition would force the price and quantity traded to $Q = 40$, $P = 10$. Would this price and quantity earn a monopolist the most profit?

Profit is simply total revenue less total cost. Economists find it useful to calculate total costs as fixed costs plus variable costs. Fixed costs are whatever costs the company must pay even if they produce nothing, for example the lease for a factory. In our example, the monopoly has no fixed costs. This is a reasonable assumption under some conditions, and it makes the exercise easier without harming the main lesson. Variable costs are what it costs to actually produce each item: that is parts, labour et cetera. On our diagram, we see variable costs as the sum of the marginal costs. To find the variable costs, calculate the area under the marginal cost curve ($MC$, and $S$ with perfect competition) up to the quantity in question. With a flat $MC$ curve this is easy. It is just the area of a rectangle, $Q \times MC = VC$.

Total revenue is quantity times the demand price, $TR = Q \times P_D$.

Find the profit at $Q = 40$.

Profit = Total Revenue ($TR$) less Total Cost ($TC$) = $TR - TC$.

Total Revenue = $TR = Q \times P_D = 40 \times 10 = 400$.

Total Cost = $TC = FC + VC = FC + \text{sum}(MC) = FC + (Q \times MC) = 0 + (40 \times 10) = 400$.

Profit = $TR - TC = 400 - 400 = 0$

No profit! Surely we can do better than that.

What if the monopoly raised the price to 40? How many could they sell? What would be the total revenue, total cost and profit?

$TR = \ldots$

$TC = \ldots$

Profit = \ldots

Now that you see that a profit of three hundred is possible, try to find the highest possible monopoly profit. What is the price and quantity that cause the highest profit (the ‘profit-maximising monopoly price and quantity’)? Use the backs and below the diagram as scratch paper.

Maximum monopoly profit =
APPENDIX 4

Program Evaluation

1) Do you feel more comfortable about taking economics this year?

2) Draw reasonable supply and demand curves in the diagram below, and label the axes.

```
  8
  6
  4
  2
  0  1  2  3  4  5  6  7  8
```

3) If there were many buyers and sellers facing your supply and demand curves, what would be the market equilibrium price and quantity traded? \( P = \_\_\_ \), \( Q = \_\_\_ \).

4) What would happen to the equilibrium price if demand increased?
   - Decrease
   - Stay the same
   - Increase
   - Not enough information
   - Don’t know

5) What would happen to the equilibrium quantity traded if demand increased?
   - Decrease
   - Stay the same
   - Increase
   - Not enough information
   - Don’t know

6) What would happen to the equilibrium price if marginal cost increased?
   - Decrease
   - Stay the same
   - Increase
   - Not enough information
   - Don’t know

7) What would happen to the equilibrium quantity traded if marginal cost increased?
   - Decrease
   - Stay the same
   - Increase
   - Not enough information
   - Don’t know

8) Refer back to your original supply and demand curves and answer in question 3, what would happen to the equilibrium price and quantity if there were one seller instead of many (and still many buyers)?

   Price would:
   - Decrease
   - Stay the same
   - Increase
   - Not enough information
   - Don’t know

   Quantity traded would:
   - Decrease
   - Stay the same
   - Increase
   - Not enough information
   - Don’t know

ACKNOWLEDGEMENTS

Helen Scarborough, Stephen Cheung, and anonymous reviewers provided useful comments. Remaining errors are mine.